4.4 Biological Resources

SIGNIFICANCE CRITERIA

Federal and California endangered species laws require protection of listed endangered or threatened species. Other special-status species include

- Species proposed for listing or designated as species of concern by the USFWS
- Species of special concern identified by the California Department of Fish and Game (CDFG), the CDFG Natural Diversity Data Baste (CNDDB) list, and CNPS's Inventory of Rare and Endangered Vascular Plants of California
- Rare and endangered plant species regardless of whether they are formally listed.

Under NEPA, impacts to biological resources would be considered significant if they result in harm, harassment, or destruction of any endangered, threatened, or rare species (including proposed species), its habitat, migration corridors, or breeding areas.

METHODOLOGY

Vegetation

The Natural Diversity Database (NDDB) for Modoc County (rev. April 05, 1999) was used to create a list of species that are likely to occur at the project location. Occurrences for the Washington Mountain and Canby 7.5' Quadrangles (September 4, 2002) were also queried using the September 4, 2002 version of Rarefind2 (an electronic database). Soil survey maps and descriptions for the project area were obtained from the Natural Resources Conservation Service (NRCS) (Chico office) prior to fieldwork. The field surveys were conducted in September 2002. A list of all plant species encountered was prepared (see Appendix F), notes were taken concerning existing environmental conditions, and a written report was completed. All plants were identified based on the taxonomy of *The Jepson Manual of Higher Plants of California* (1993). Any plant species that were not identifiable at the project site were collected, later identified, and then added to the original species list. Plant communities were identified using *A Manual of California Vegetation* (1995) in the field and delineated on aerial photographs. The common names for many species were acquired from The CalFlora Database, an online electronic resource (September and October 2002).

Wildlife

A records search was conducted to determine if any special-status species were previously reported within the assessment area. A review of files maintained by the CDFG Natural Diversity Data Base (CNDDB 2001) was also conducted. The CNDDB is a computerized inventory of information maintained by CDFG on the general location and status of California's rare and threatened animals, plants, and natural biological communities. The CNDDB includes information on reported sightings only. Those state-listed and sensitive wildlife species occurring within the quadrangle that encompasses the project area are also presented in Appendix F.

The Klamath Falls office of the USFWS was contacted for a summary of all federally listed, proposed, and candidate species within Modoc County. The USFWS list of wildlife and fish species is presented in

Appendix H. USFS biologists for the Modoc National Forest were also consulted for information about known threatened and endangered species in the project area. A literature search was performed for information on foraging habitats on the Pit River.

Once a list of potential rare, threatened or endangered wildlife species from both the Federal and State sources was obtained, an assessment area for potential impacts or disturbances to these species was determined. The assessment area was defined as the route from the geothermal well to the Pit River, the immediate area of discharge, the immediate area downstream from the point of discharge, and any potential breeding habitat for sensitive species within several miles of the project. This distance was chosen to encompass the range of any potential or known raptor territory and nest sites.

The habitat analysis for sensitive species was conducted in two phases. First, the records of the CNDDB were searched as described above, and added to the correspondence provided by the USFWS and USFS. Any listed species with no potential for habitat within the assessment area, such as marine-dependant species, were dropped from the list for analysis. Next, a field investigation was conducted to observe habitat conditions and define habitat occurring on or near the project site and within the assessment area. The field investigation was conducted in August 2002 (Galea 2002). All potential habitats within the assessment area were assessed for their potential for listed species.

OVERVIEW OF EFFECTS OF PROJECT ALTERNATIVE A

A Biological Assessment (BA) has been prepared in coordination with the USFWS based on the analysis presented below. The BA is based on the information contained in the biological resources section of the EA

Construction Impacts

The primary construction-related effect on biological resources would result from the construction of the pipeline transporting effluent to the Pit River. The PVC line would be trenched into the ground (at 2 feet wide by four feet deep) beginning at the I'SOT facility in Canby on the north side of Route 54, continue through a pasture, under an existing roadway, and under Route 299 (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). Once across the highway, the trenched line would be placed underground through another existing pasture. The line would then be ditched into an existing, raised berm running through a wet pasture area along the Pit River, which provides vehicular access to the concrete weir. The pasture area contains federally protected wetlands as defined by Section 404 of the Clean Water Act (see Appendix E); however, utilizing the raised berm for access minimizes impacts to the wetland areas. The trenching of the pipeline would involve temporary removal of small amounts of soil and vegetation, which would have a minimal effect on plant life in the project area. Vegetation would be replaced when the trenching is completed.

Operational Impacts

The primary impact of operation is the discharge of geothermal effluent (that contains mercury) to the Pit River. The discharge could have an impact on fish and foraging migratory and resident birds. Other operational effects to wildlife, vegetation, and livestock could result from a break or leak along the length of the pipeline. With mitigation, the impacts to wildlife would be less than significant.

GENERAL VEGETATION AND WETLANDS

Impact Overview

Small amounts of vegetation would be temporarily disturbed during the placement of the PVC pipeline along the mile-long route to the Pit River. For the portion of pipeline that traverses the sagebrush steppe habitat area, there would be minimal impact on existing vegetation and minimal impact on wildlife habitat because this land has been almost completely converted to agricultural and residential use. In the portion traversing wetland habitat, impacts to the area would be minimized because the majority of ground plant mass has been removed by heavy cattle grazing and the pipeline will follow an already established levee. Installation of the pipeline will result in temporary disturbance to 0.03 acres of jurisdictional wetland. If a leak or break occurs along the pipeline there could also be some impacts to adjacent vegetation from the accidental discharge of geothermal fluids. Mitigation is defined to ensure minimal disturbance or potential disturbance to wetland and drainage habitat. Specific potential impacts and mitigation measures are identified below.

Removal of Vegetation During Pipeline Construction

Vegetation. Excavation for the pipeline would include using a trenching implement on the back of a track-type tractor or similar device. The trench will be 2 feet wide by 4 feet deep. The upland two thirds of the project pipeline can be described as sagebrush steppe; however, most of the natural community has been converted into either residential dwellings or agricultural fields (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). Imported fill material as well as surrounding soil was used in the construction of this levee system. Most of the area comprising the top of the levee is void of vegetation and shows no signs of wetland conditions. With the exception of 0.03 acres (Appendix E) the entire levee system has been delineated as upland, non-wetland habitat. Alternative Route A follows an existing levee system and is virtually denuded of vegetation.

The temporary loss of this vegetation during pipeline construction would not be significant. The impacts of the temporary project disturbance and removal of vegetation in this area would also be less than significant. Potential effects to sensitive species are described below.

Since the project does not involve a significant soil disturbance, opportunity for soil erosion is small. The project is not a large industrial project, and does not require a Storm Water Prevention Pollution Prevention Plan (Rohrbach, personal communication 2002).

Wetlands. In the wetland area that the pipeline traverses, a levee system bisects the area leaving the northward side drier than that of the unaltered wetland system that is adjacent to the Pit River drainage (see Canby/Geothermal Project Area and Habitat Designations in Appendix E). The severity of the cattle grazing in this wetland has left only sparse plants and a dominance of grass species. Vegetation in this area is most likely hydrophytic (water dwelling) because of the prominence of wetland soils and wetland hydrology.

The pipeline construction would affect 0.03 acres of wetland vegetation. There would be some disturbance to the vegetation that would be temporarily removed during trenching. This disturbance would be significant without mitigation; however, mitigation measure 4.4-1 would reduce the effects to vegetation to a less than significant level by requiring that excavated vegetation be retained and replaced after the pipeline is installed.

The pipeline construction could also affect the wetland water drainage due to the digging of a trench that could collect water in the wetland. A change in drainage could affect vegetation. Mitigation measure 4.4-2 would reduce the effects on wetland drainage effects to less than significant levels.

Mitigation Measure 4.4-1

To minimize the impacts to removed vegetation in the wetlands and other areas, during trenching, I'SOT will ensure that soil will be placed on either side of the trench. As much of the soil with its original vegetation as needed to return the ground to the original contour will be replaced immediately after the pipeline installation is completed. Due to the bedding material and pipe diameter, all of the removed soil will not refill into the trench; however, the fill soil will contain enough of the original vegetation to retain plant growth.

Mitigation Measure 4.4-2

To reduce likelihood of affecting drainage in the wetlands, I'SOT will carefully plan the timing of project implementation. I'SOT will perform construction activities adjacent to drainages and wetlands would be performed when the probability of heavy rain is minimal and inundation of the project wetlands is reduced due to manipulation of the weirs. This driest time, when construction would be carried out, falls between February and March. Replacement of weir boards occurs on April 1st, causing the drained wetlands to be re-saturated by the summer months.

PIPELINE LEAKS OR BREAKAGE

As discussed in Section 4.4, Hydrology and Geothermal Resources, pipeline breakage is unlikely and will be monitored and corrected by implementation of mitigation measure 4.3-2. The depth of the pipeline (3 feet below ground surface) eliminates the risk to vegetation. The pipeline is laid on a gravel bed, which promotes the downward drainage of any leakage. On-site plants have shallow root systems and would not be affected by such leakage. Additionally, in the event of a leak, the escaping water would be post-treatment. Mercury levels in the water are at concentrations deemed safe for drinking water. Boron does not bioaccumulate and arsenic bioaccumulates at an insignificant rate from soil into plants (Savannah River Site 1999). No special-status plants were found along the pipeline route. The risk to plants from pipeline leaks or breakage is less than significant.

SENSITIVE PLANT SPECIES

Most of the proposed project would occur on areas that support little vegetation; however, a minimal amount of wetland area would be disturbed during trenching resulting in a significant but temporary impact. The total discharge pipeline disturbs 6.2 acres including 25 feet on both sides of the piping. Only 0.03 acres of wetland would be directly affected. No special status species were identified in the fall 2002 Botanical Survey (Appendix F); however, the time of year when the botanical survey was completed is less than optimal for the identification of many annual species that have potential habitat on site. Table 4.4-1 summarizes impacts to special status plants present or plants potentially present at the project site. Specific potential impacts and mitigation measures are identified below.

Table 4.4-1: Summary Of Potential Impacts To Special Status Plants At The Project Sites

Species	Status	Potential Impacts
Boggs Lake hedge-hyssop (*Gratiola heterosepala*)	State E, CNPS 1B	Damage or loss of existing plants along pipeline in wetland area south of Canby
Howell's thelypodium (*Thelypodium howellii ssp. howellii*)	CNPS 1B	Damage or loss of existing plants along pipeline in wetland areas
Long-haired star-tulip (*Calochortus langebarbatus var. longebarbatus*)	CNPS 1B	Damage or loss of existing plants along pipeline in wetland area
Eel-grass pondweed (*Potamageton zosteriformis*)	CNPS 2	Damage or loss of existing plants along pipeline in Pit River drainage
Hillside arnica (*Arnica fulgens*)	CNPS 2	Damage or loss of existing plants along pipeline in wetland area in the south end of the project
Falcate saltbush (*Atriplex gardneri var. falcata*)	CNPS 2	Damage or loss of existing plants along pipeline in upland project area

State: E-Listed as endangered under the California Endangered Species Act
CNPS: 1B-plants rare, threatened or endangered in California and elsewhere; 2-rare, threatened or endangered in California but not elsewhere (California Native Plant Society).

SOURCE: Stuart Consulting 2002, NDDB Quad Search, 2002, USFWS Modoc County List

Boggs-Lake Hedge-Hyssop, Hillside Arnica, Long-Haired Star-Tulip, Howell's Thelypodium

Boggs-Lake Hedge-Hyssop, Hillside Arnica, Long-Haired Star-Tulip, and Howell's Thelypodium were not found in the surveys of the project area; however, each of these species was initially determined to be potentially present within the project area based on geographic range and suitable habitat conditions of the wetland areas. The levee road is bare of vegetation due to use as a vehicle access road. The 0.03 acres of wetland the pipeline crosses before terminating at the Pit River lacks suitable habitat to support any of these species. (Kristiaan Stuart, personal comm., 2002c). There would be no significant impact on any of these species.

Falicate Saltbrush

Falicate Saltbrush is known to occupy open alkaline soils in sagebrush scrub and is known to occur 0.3 miles northeast from the project area (Appendix F). Much of the upland habitat in the project area previously had suitable habitat for this species; however, under the current agricultural and grazing regime it is very unlikely that this perennial species would be found within the project area. There would therefore be no impact to the species.

Eel-grass Pondweed

Eel-grass pondweed is an aquatic, annual herb that occupies freshwater wetlands including ponds, lakes, and streams. The species has been collected on the Pit River drainage within the project area, even though its occurrence was not detected during the project botanical survey. It should be assumed that this species is present since the survey was conducted at the wrong time for detection and the project

habitat is ideal for its presence. Eel-grass pondweed could be significantly impacted by construction activities.

Mitigation Measure 4.4-3

I'SOT will place a sedimentation barrier fence should be placed adjacent to and on either side of the trench through the 0.03 acres of wetland. The fence shall remain in place until the construction is complete to prevent sediment from collecting on and damaging any eel-grass plants.

WILDLIFE

Impact Overview

No direct impacts to wildlife species are likely to result from the construction of the portion of the pipeline that traverses through the town of Canby, through fallow agricultural fields in town, and under roadways. The wetland habitat has been heavily grazed and is marginal habitat for wildlife. Temporary disturbance of wetlands for installation of the pipeline would not have a significant effect on wildlife.

Suitable breeding habitat was found within the assessment area for some ground nesting bird species, such as the greater sandhill cranes and ibis, although extensive grazing, high number of grazing cows, and lack of tall vegetation may make nesting more difficult. The lack of trees, brush, or other tall vegetation reduces the potential for tree-nesting avian species in proximity to the project. There would be no impact on breeding and nesting habitat due to the disturbed nature of the construction area.

Potential foraging habitat is found to be available for some of the sensitive species in the area, especially avian predators; however, the project construction requires little equipment, involves a small area of land, and is temporary. For these reasons there should be minimal or no impact on raptor foraging in the project area. Potential habitat for many of the sensitive fish species was found to be available in the Pit River.

The effluent discharge into the Pit River would contain arsenic, boron, and mercury. While the effluent constituents do not create a significant impact to water quality (refer to section 4.3, Hydrology and Geothermal Resources), the metal levels in the effluent could represent a potentially adverse affect to wildlife through bioaccumulation in the ecosystem. Table 4.4-2 provides a comparison of current and projected Pit River concentrations for arsenic, boron, and mercury to standard concentrations for these metals set by the EPA as being protective of aquatic life in freshwater. Discussion of mercury is addressed below. After dilution, the levels of arsenic in the river are projected to be less than the EPA standard levels. The EPA has not set a level for boron; however, the post-dilution boron concentration in the river is projected to be below the NPDES permit level. These two metals do not bioaccumulate at significant rates (The Savannah River Site 1999) and therefore would not impact wildlife preying on river species. The trace amounts of mercury in the operational fluid discharge into the Pit River could have potentially significant effects on fish and bird species through bioaccumulation. Mitigation measures will avoid or reduce these effects to less than significant levels.

Table 4.4-2: Comparison Of Current And Projected Concentrations Of Key Contaminants Of Concern In The Pit River Against USEPA National Recommended Ambient Water Quality Criteria For The Protection Of Aquatic Life In Freshwater

Inorganic Constituent	Current Level in Pit River	Projected Level in Pit River	Concentration Limit
Arsenic (µg/L or ppb)	3.74 [a]	5[b]	150[c]
Boron (µg/L or ppb)	108[a]	271[b]	none established
Mercury (inorganic) (ng/L or ppt)	1.72[d]	< 4[b]	770[c,e]

Notes and Sources:
a. DWR 2002.
b. Calculated; see text.
c. Expressed as dissolved. EPA 1999.
d. Appendix I.
e. Criterion derived from data for inorganic mercury (II), but is applied to total mercury. It will probably be under protective if a substantial portion of mercury in the water column is methyl mercury. Derivation of criterion did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels. EPA 1997.

Effects of Project Discharge on Aquatic Habitat and Species

Project-Associated Mercury Discharge. The proposed project would add small amounts of mercury to the Pit River, which could affect aquatic life and predators that utilize the river as a food source through the process of bioaccumulation (refer to Section 3.4 Biological Resources for a definition of bioaccumulation). The proposed granulated activated carbon system (GAC) is expected to reduce effluent mercury levels by 92 to 99% resulting in a maximum projected mercury concentration in the discharge to be 19 nanograms per liter[1] (ng/L) (Appendix I). Analytical data for the geothermal effluent from the proposed project indicated an average mercury concentration of 9.7 ng/L for project flow (Appendix D). The total mercury deposition would be less than the level defined in the permit because the proponent plans a maximum of 37 gpm in winter and around 10 gpm for summer heating, resulting in only a small increase in mercury concentration in the river due to the project. The project permit allows discharge of 60 gpm with 50 ng/L of mercury.

Mercury Concentration in the Pit River after Project Discharge. The proposed project would result in a low level of mercury being discharged into a river system. The final concentration of mercury in the Pit River depends on the flow rate of the river, the discharge rate, the concentration of mercury in the discharge, and the concentration of mercury in the river.

A mixing zone study determined the degree of dilution given certain variables of the project (Appendix J). Greater volumes of effluent would be discharged during the colder winter months, where there is a greater volume of water running through the Pit River system. The NPDES permit indicates that the ratio of thermal effluent to river water cannot be greater than 1:22.5. The mixing zone study suggests that complete mixing will occur within 20 feet downstream of the effluent discharge point, even though the NPDES permit established a mixing zone of 425 feet to the County Road 54 Bridge. Analysis shows that at the maximum project effluent discharge rate of mercury at 50 ng/L and 60 gpm, the concentration of

[1] A nanogram is 1 x 10^{-9} grams

mercury in the river would be less than 4 ng/L. (Figure 4.4-1). During most of the year when the flow of the Pit River is higher, the final concentration of mercury in the Pit River will only change by a few hundredths of a nanogram (Figure 4.4-2).

The EPA criterion for mercury concentrations in water for the protection of aquatic life (EPA 1998) is 770 ng/L. The maximum predicted mercury water concentration level of 4 ng/L does not violate any standards to protect humans or aquatic life. Mercury bioaccumulation from the project discharge would probably be at a variable rate due to the flowing body of water with an indeterminate volume. The proposed project could raise the concentration of mercury in the Pit River, which could potentially impact wildlife in and around the river (see the analysis below).

Mitigation Measure 4.4-4

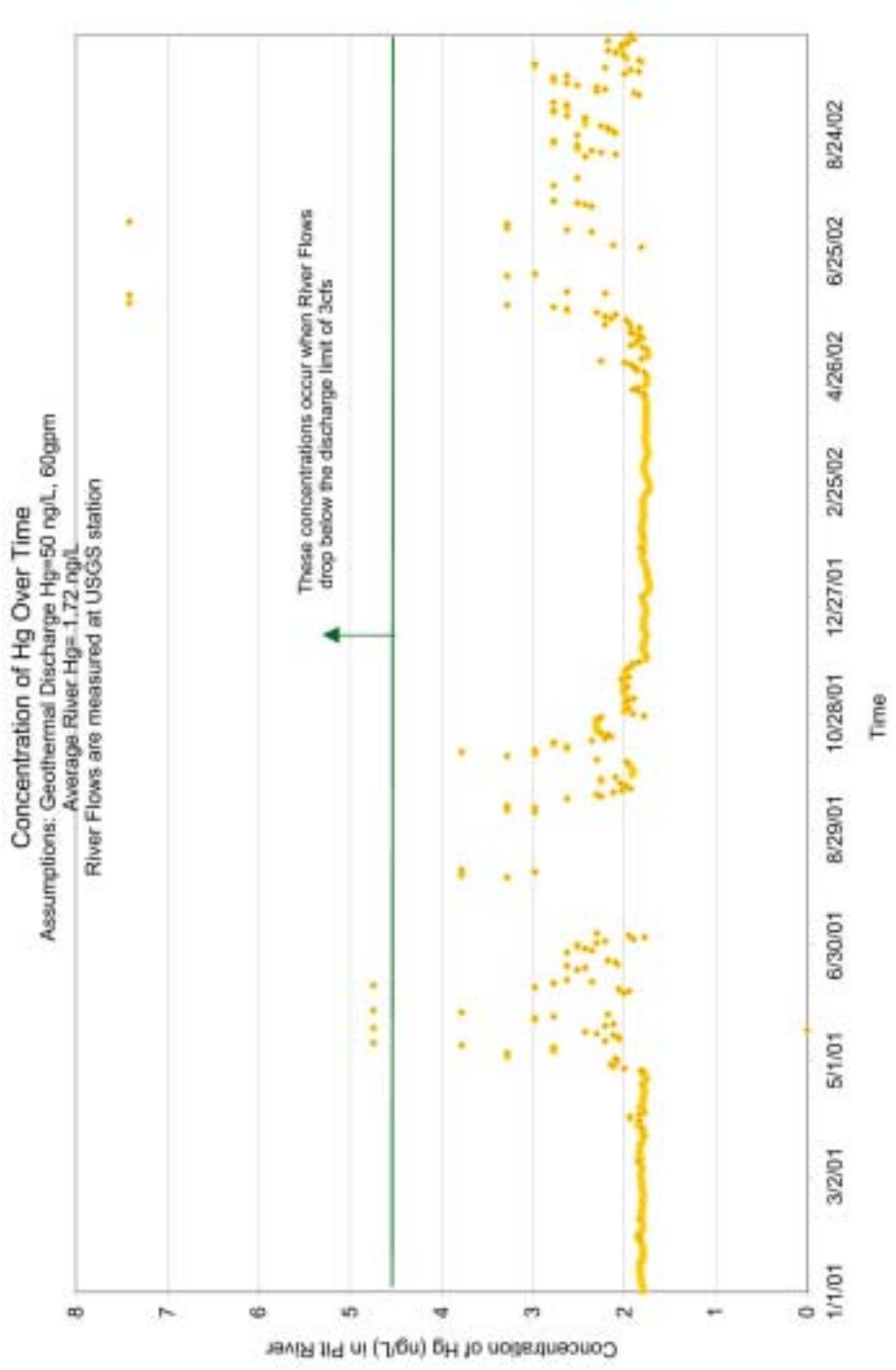
~~**4.4-4.** The concentration of mercury in the effluent will be monitored monthly. The Pit River water concentration will also be monitored monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit.~~

~~If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.~~

I'SOT shall monitor the concentration of mercury in the effluent for six months and quarterly thereafter Refer to Mitigation Measure 4.3-3 (Hydrology and Water Quality) for requirements for replacement of the GAC filters. I'SOT shall also monitor the Pit River water concentration monthly at two stations, one 50 feet upstream from the point of discharge and the other 425 feet downstream from the point of discharge as stated in the NPDES permit. I'SOT shall provide test results to NREL for the first 3 years of operation

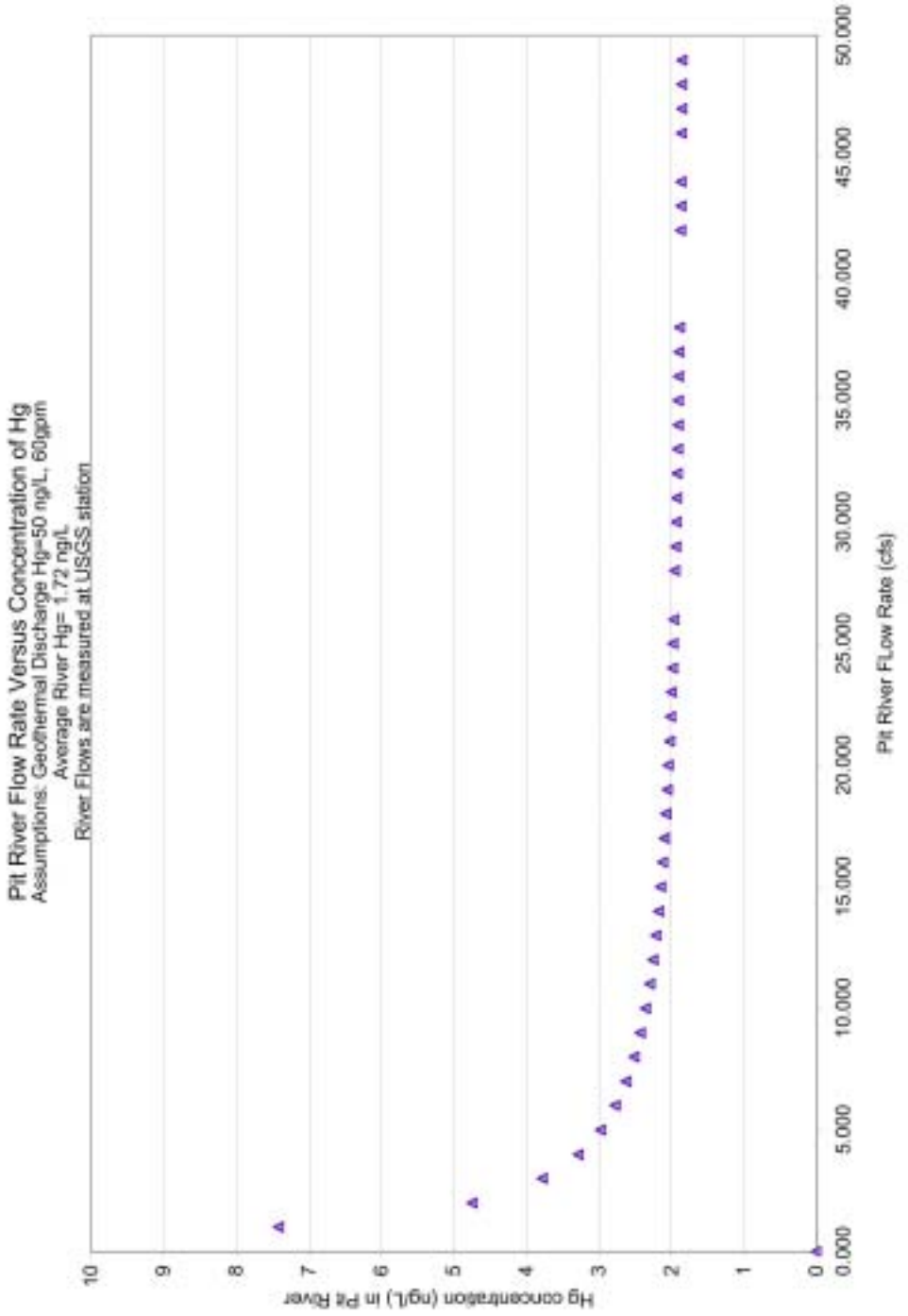
If the mercury concentration in the effluent exceeds the permit level of 50 ng/L, if concentration in the river exceeds 50 ng/L, or if assessment of the monitoring activities (including chronic toxicity testing, and fish residue analysis) suggests that discharge may result in significant increase in risk of mercury bioaccumulation in fish tissue I'SOT shall coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Measures to reduce the effect could include, but are not limited to, temporary cessation of discharge temporary collection and proper disposal of discharge until the concentrations decrease, alternative filter systems, or injection of the spent geothermal fluids back into the geothermal reservoir.

Figure 4.4-1: Concentration of Mercury over Time



SOURCE: Geologica 2002

Figure 4.4-2: Pit River Flow Rate Versus Concentration of Mercury



SOURCE: Geologica 2002

EFFECTS ON SENSITIVE WILDLIFE SPECIES

Several sensitive wildlife species listed in Table 4.4-3 may occur in the area of the project. The construction of the pipeline as well as the toxins in the effluent could directly or indirectly harm these species.

Table 4.4-3: Summary of Potential Impacts to Special Status Animals Occurring at the Project Sites

Species	Status	Potential Habitat Affected	Potential Impact
Birds			
Greater Sandhill Crane	California Threatened	Foraging, Reproductive	Prey contamination
Bald Eagle	Federally Endangered/ California Species of Concern/ California Fully Protected	Foraging	Prey contamination
While Faced Ibis	California Species of Concern	Foraging, Reproductive	None
Golden Eagle	California Species of Concern/ California Fully Protected	Foraging	None
Fish			
Modoc Sucker[1]	Federally Endangered/ California Endangered	~~None~~ Foraging	~~None~~ Habitat contamination

SOURCE: Galea 2002, NDDB Quad Search 2002, USFWS Modoc County list

1. Modoc Sucker is not known to occur in the project area according to surveys. Potential impacts are discussed because a few individuals undetected by the surveys could potentially be in the main stem of the Pit River. ~~it is a federal and California listed endangered species.~~

Bald Eagle

The U.S. EPA and the USFWS have established methyl mercury standards for the protection of the bald eagle. The three mercury standards include a daily methyl mercury intake limit, a tissue concentration limit for aquatic prey (fish), and a water concentration for prey habitat. These standards along with current and projected methyl mercury concentrations are outlined in Table 4.4-4. Further discussion and analysis of these standards is addressed below.

The U.S. EPA calculated a reference dose (RfD) for methyl mercury for avian species based on the "chronic, no observed adverse effect level" (NOAEL) from studies on mallard ducks. The RfD is defined as the daily intake (in nanograms mercury per kg body weight per day) that may occur without appreciable risk of any adverse effect on the organism; the value calculated for this bird was 21,000 ng /kg body weight per day (21 µg/kg body weight per day). Species-specific water concentration values for methyl mercury were estimated as the ratio of an RfD, to the estimated methyl mercury consumption rate for the species. The limit for bald eagles has been set at 0.082 nanograms per liter (ng/L) (EPA 1997) (see Table 4.4-4).

Table 4.4-4: Comparison Of Current And Projected Methyl Mercury Concentrations And Dosing Levels Against Limits And Levels Deemed Protective For Birds

	Current Conditions	Projected Worst Case Conditions[a]	Standard/Threshold	
			EPA	FWS
Methyl Mercury Concentration in Water (ng/L)	0.255[b]	0.558[c]	0.082[d]	n/a
Methyl Mercury Concentration in Fish Tissue (ng/g)	0.409[b]	0.895[c]	n/a	95[e,f]
Eagle's Intake of Methyl Mercury (ng/kg of body weight/day)	49[b]	107	21,000[d]	n/a

Notes and Sources:

a. Projected values based on NPDES permit limits (worst case conditions) of effluent at 50 ng/L mercury, a maximum discharge rate of 60 gpm, and a minimum river flow rate of 3 cfs).

b. Frontier Geosciences, Inc. Total Mercury in Tissue Analysis for I'SOT Project October 2002 (Appendix I).

c. Calculated; see text.

d. U.S. EPA limit protective of birds, also known as a "reference dose" or "RfD". EPA 1997.

e. Calculated from total mercury concentration limit in fish tissue for consumption by birds of 100 ng/g and a total mercury to methyl mercury conversion factor of 0.95.

f. Eisler, Ronald. 1987. Mercury hazards to fish, wildlife, and invertebrates: a synoptic review. U.S. Fish and Wildlife Service. Biological Report 85 (1.10).

The project effects on water quality and biological resources are described below.

Predicted Mercury Concentration in Pit River from Project. Project effects on water quality are described in Section 4.3 Hydrology and Geothermal Resources. The effects are summarized here. The proposed project would not significantly increase the concentration of mercury in the Pit River water (Figure 4.4-1 and Figure 4.4-2). At times when the river flow rate is lowest (but still higher than 3 cfs, the minimum discharge limit set by the NPDES permit to discharge effluent into the river), the final concentration in the river taken 425 feet downstream would be less than 4 ng/L (refer to Figure 4.4-1 for the maximum final concentration of mercury in the Pit River). A concentration of 4 ng/L falls below regulatory thresholds for protection of humans and aquatic species. The final concentration of mercury in the river would only reach 4 ng/L under the worst-case conditions where 50 ng/L mercury is discharged in effluent at a rate of 60 gpm would be discharged into the river and the river flow is 3 cfs. Such discharge conditions are not anticipated to occur since low river flows are experienced during the summer when use of the district heating system would be minimal. Under normal operating conditions the increase in mercury concentration above current levels will usually only be a few hundredths of a nanogram, for a total mercury concentration of less than 2 ng/L.

Predicted Methyl Mercury Concentration in Pit River From Project. The final concentration of methyl mercury in the Pit River after discharge from the proposed project can be estimated by taking a ratio of current mercury (1.72 ng/L) to current methyl mercury (0.255 ng/L) concentrations in the river (see Table 4.4-4). After discharge, the predicted maximum total mercury concentration in the Pit River of 4 ng/L would translate into an expected methyl mercury concentration of 0.558 ng/L.

$$\frac{\text{CURRENT: 1.72 ng/L mercury}}{\text{0.255 ng/L methyl mercury}} = \frac{\text{PREDICTED: 4 ng/L mercury}}{\text{X ng/L methyl mercury}}$$

X = 0.558 ng/g methyl mercury

This level would not exceed water quality standards. This level is above the standard of 0.082 ng/L methyl mercury set by EPA as being protective of bald eagles. The baseline level of methyl mercury in the Pit River of 0.255 ng/L is above the standard. The existing methyl mercury levels in the Pit River are above the EPA-defined levels for protection of birds; however, analysis indicates that bioaccumulation of methyl mercury in fish tissue is not happening at as high a rate as theoretical models predict. The project would be adding more methyl mercury to an already exceeded level. It is unlikely that bald eagles would be jeopardized because fish tissue concentrations would be well below the allowable limit (refer to the fish tissue limit calculation below and the analysis thereafter for further discussion of this conclusion). The mercury discharge would not result in a significant effect.

Predicted Bioaccumulation in Fish Tissue From Project. For the predicted methyl mercury concentration of 0.558 ng/L, we can predict the estimated bioaccumulation in the fish tissue based on current methyl mercury concentrations and current bioaccumulation in the fish tissue. At the discharge point, the methyl mercury in the water is 0.255 ng/L and the methyl mercury in the fish tissue is 0.409 ng/g (see Section 3.3 Hydrology and Geothermal Resources and Section 3.4 Biological Resources). If the concentration in the water became 0.558 ng/L methyl mercury, bioaccumulation would result in fish tissue having a concentration of 0.895 ng/g methyl mercury, which is well below the limit of 95 ng/g established by the FWS as being protective of bald eagles. Despite the methyl mercury level in the water exceeding the EPA limit, the methyl mercury concentration in the fish tissue is well below the limit.

$$\frac{\text{CURRENT: 0.255 ng/L methyl mercury (water)}}{\text{0.409 ng/g methyl mercury (fish tissue)}} = \frac{\text{PREDICTED: 0.588 ng/L methyl mercury (water)}}{\text{X ng/g methyl mercury (fish tissue)}}$$

X = 0.895 ng/g

The bioaccumulation of mercury in fish would not result in a significant impact on fish or bald eagles.

Predicted Mercury Consumption in Bald Eagles. Performing the calculation for total methyl mercury intake by bald eagles, a 4 kg bird eating 0.48 kg (480 g) of contaminated fish would consume 430 ng of methyl mercury per day. This translates into 107 ng/kg body weight per day, which is well below the intake limit of 21,000 ng/kg body weight per day.

$$480\text{ g} \times \frac{0.895\text{ ng}}{\text{g}} = 430\text{ ng} \quad \text{THEN} \quad \frac{430\text{ ng}}{\text{4 kg body weight}} = 107\text{ ng/kg of body weight}$$

The project discharge would not result in a significant effect to fish or bald eagles that might consume the fish.

Analysis of Effect on Bald Eagles. The EPA has set a concentration limit of 0.082 ng/L (82 pg/L[2]) for methyl mercury in water as being protective of bald eagles (EPA 1997). Currently, the existing methyl mercury concentration in the Pit River at the discharge point is above the EPA level at 0.255 ng/L (255 pg/L). The proposed project would increase the methyl mercury level to as high as 0.558 ng/L; however, analysis based on current conditions seems to indicate that fish tissue methyl mercury calculations do not exceed standards despite the high level in the water. In a report by the US Fish and Wildlife Service addressing mercury hazards to fish, wildlife and invertebrates, it is recommended that fish tissue consumed by birds have a mercury level of less than 100 ng/g (Eisler 1987). Using a total mercury to methyl mercury conversion factor of 0.95, this translates into 95 ng/g methyl mercury limit in fish tissue (Eisler 1987)(see Table 4.3-4). The current fish tissue concentration is only 0.409 ng/g methyl mercury and the predicted concentrations with the proposed project would be 0.895 ng/g in a worst case scenario (see Section 3.4 Biological Resources and refer to Table 4.3-4).

It is difficult to determine why the fish tissue concentrations are lower than expected given the relatively high free mercury concentrations in the river. Most bioaccumulation models are designed for closed systems such as lakes. In a river system, various factors may account for reduced bioaccumulation. ~~The constant movement of fish upstream and downstream may expose them to mercury concentrations that vary from those concentrations in the project area. Another~~ One possibility is that there may be fewer levels in the food chain in the Pit River than expected, resulting in less bioaccumulation in the fish tissue. Another possibility may be that the relatively high methyl mercury concentrations observed during the summer months are ephemeral. Based on fish tissue concentration data, bioaccumulation in Pit River fish is less than predicted by theoretical models.

There are indications that local eagles have not been adversely affected by existing conditions at the river. A typical effect of bioaccumulation of mercury in bald eagles is reduced reproductive success due to eggshell thinning and behavioral problems. The closest bald eagle territory is only one mile away from the project area; however, that nest has been unusually successful hatching 2-3 young twice and only failing three times in twelve years (USFS data, Romberger 2002b). Bioaccumulation of mercury in bald eagles would be even lower than these estimates because fish do not constitute 100% of bald eagle diet. A study on Pit River bald eagle ecology indicated that fish comprised approximately 88% of the diet of bald eagles found foraging in the Pit River (Hunt 1992). Bald eagles are also known to have other food sources such as waterfowl, ground squirrels and fish from local reservoirs, all of which may or may not contribute additional mercury to the eagles through diet.

The proposed project will increase the level of methyl mercury in the Pit River from 0.255 ng/L to a maximum of 0.558 ng/L when the level is already above the limit set by the EPA (0.082 ng/L) for the protection of bald eagles (see Table 4.4-4). The free mercury in the Pit River is higher than the EPA limit; however, current and predicted fish tissue concentrations are much lower than the USFWS published limit for the protection of bald eagles. Water standards are intended to limit the amount of mercury available for bioaccumulation based on theoretical models. As discussed earlier, there are several reasons why bioaccumulation is not occurring at theoretical rates in the Pit River, including movement of fish, fluctuating levels of mercury in the Pit River and reduced levels in the food chain. The mercury levels in

[2] pg/L=picograms per liter. A picogram is 1 x 10^{-12} grams.

the Pit River seem to fluctuate greatly from year to year (refer to Section 4.3 Hydrology and Geothermal Resources). Bald eagles accumulate mercury directly from fish and not from water; therefore, fish tissue concentrations provide a clear indicator of mercury consumption by the eagles. Mercury accumulates in tissue over the lifespan of the fish. This makes fish tissue levels a good indicator of long-term bioaccumulation rates, and compensates for seasonal and annual fluctuations in river conditions and thus mercury levels in the Pit River over time.

The additional mercury added to the Pit River should not increase fish tissue concentrations by an appreciable amount. These concentrations would remain far below the fish tissue limits to protect bald eagles, even in a worst case discharge scenario of 50 ng/L, at 60 gpm, with a river flow of 3 cfs. While it is highly unlikely, if conditions changed in the Pit River, or other unforeseen factors contribute to bioaccumulation causing fish tissue levels to exceed 100 ng/g, there could be a potentially significant adverse effect to bald eagles. Mitigation measure 4.4-5 would reduce these potentially significant effects to a less than significant level.

Mitigation Measure 4.4-5

In accordance with the NPDES permit, I'SOT shall collect samples of Sacramento pike-minnow or other appropriate species and whole body concentrations of mercury will be determined at least every other year. I'SOT shall devise a sampling plan with the species of fish, number to be collected, the age of the fish and the method of aging in consultation with USFWS and CDFG. The sampling plan and protocol shall be submitted to the Executive Officer of the CVRWQCB, USFWS, and CDFG for approval. ~~If fish tissue concentrations exceed 100 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.4-4 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.~~ Current levels of mercury in fish tissue average 0.4 ng/g. The maximum projected increase in fish tissue concentration is to 0.895 ng/g. If the tissue mercury concentration averages above 5 ng/g, then the proponent will coordinate with the RWQCB, CDFG, and USFWS to determine appropriate mitigation. Mitigation measures might include those measure outlined in Measure 4.3-5 to reduce mercury discharge to the river, as well as actions to improve or enhance local eagle foraging or nesting conditions in the area, as coordinated with USFWS and CDFG.

Greater Sandhill Crane

Greater sandhill cranes breed in large wetlands and feed in different habitat types such as meadows, irrigated pastures, grain fields, bogs, fens, marshes, and nearby fields. Cranes like to flock together at night (called roosting) for safety in an open expanse of shallow water. Cranes are omnivorous, and eat a variety of grains and seeds, but also eat aquatic invertebrates, insects, small reptiles, amphibians, eggs, and rodents as well as some fish. Fish do not constitute a significant portion of their diet.

The greater sandhill crane is known to nest and forage in the study area around the project. Although no nest sites are recorded within 0.5 miles of the project area, known nesting sites occur approximately 0.5 miles down river.

No direct habitat alteration will occur from this project. Prey species for sandhill cranes could potentially be impacted by contaminants released in the discharge; however, cranes typically eat frogs and aquatic insects of a lower food chain levels than pike minnow. These prey items are lower on the food chain and

methyl mercury tissue concentrations increase with increasing predator-prey relationship levels. Greater sandhill crane prey would have significantly lower concentrations of mercury than pike minnow. Consumption of prey would therefore have less than significant impacts to cranes.

Golden Eagle

Golden eagles require open country for foraging. They prefer to nest in large conifers at the periphery of dense stands or on cliffs. Golden eagles are relatively common in the Canby area, and likely forage occasionally in the project area due to the open terrain and potential availability of food such as waterfowl and ground squirrels.

No habitat alteration would result for this species due to this project. The majority of golden eagle prey is not affected by mercury bioaccumulation. These birds prey upon a variety of creatures from prairie dogs, cottontail rabbits, jackrabbits and ground squirrels to grouse, ducks, chukars, reptiles and smaller birds (www.enature.com, www.desertusa.com, 2002). Most waterfowl listed above feed on vegetation in the wetland areas and therefore would not be affected by bioaccumulation of mercury in fish. There is no suitable nesting habitat in the project area; the project would not affect golden eagle nesting. Therefore, there should be no significant impacts to this species by this project and no mitigation is necessary.

White Faced Ibis

The white faced ibis has potential foraging habitat in the study area in the existing wetlands. Potential ibis breeding habitat in the heavily vegetated wetland areas is adjacent to, but not in, the direct impact area of the project (e.g. the pipeline route). Potential ibis foraging habitat exists in the wetlands area associated with the pastures, although this habitat is of lower quality because of the intensive grazing in that area. Impacts from construction to breeding and foraging habitat would therefore be less than significant because construction activities would not directly affect nearby breeding habitat and would involve minimal disturbance to potential but low quality foraging habitat in the project area. The white face ibis also feeds on a variety of different animals that live in and around a marsh. They primarily feed in marshland areas and would not be significantly impacted by mercury bioaccumulation from consumed prey.

Modoc Sucker

The Modoc sucker is listed as endangered by the USFWS and by the State of California. The species is endemic to the small tributary streams of the Upper Pit River, and is currently restricted to several tributary streams of the Pit River, including Turner and Ash Creeks, which are tributaries located ~~20~~ 7 miles downstream of the proposed discharge. In general, sites where Modoc suckers have been found are characterized by the following: low flows (intermittent in some); largely shallow pools; muddy bottoms; partial shade trees, shrubs, boulders, or undercut banks; abundant cover from riparian vegetation and undercut banks; and moderately clear water. The Modoc sucker prefers portions of small streams dominated by large, shallow, muddy- bottomed pools, partially shaded by overhanging trees. Spawning occurs over coarse fine gravel in the lower end of pools with abundant cover. This type of habitat is not found in the project area. They feed on filamentous algae.

Recent surveys by USFWS staff found no morphological Modoc suckers in the main stem of the Pit River downstream of the project areas, even though the project area is in historical habitat and suitable habitat exists. There may be some individuals not detected by the surveys suggesting that Modoc sucker do exist in low abundance in the project area (Reid pers. comm. 2002a). Currently, the closest known Modoc

sucker occupied area in the project vicinity is the Turner Creek drainage which begins about 7 miles downstream from the Pit River discharge point and is up from its confluence with the Pit River, where the project effects would be unlikely to extend (Reid pers. Comm. 2002b). ~~Modoc sucker is not known to occur within the project area or immediately downstream in the Pit River, based upon recent surveys conducted by the USFWS specifically for this project (Reid, personal communication 2002). The closest known occupied portion of the Pit River is 20 7 miles downstream~~ (refer to Figure 3.3-1 for map of territories). ~~Modoc sucker is known to hybridize with the Sacramento sucker and genetic tests were conducted to determine if any hybrid individuals were found in the Pit River (USFWS 2002b). The initial morphological analysis from the genetic survey did not show any hybrid Modoc sucker in the Pit River (Reid 2002). In order for a hybrid to exist, there would have to be pure Modoc suckers in the River, which were not found.~~

The project should cause less than significant impacts to any Modoc suckers potentially living in the river near the project area. Current fish tissue samples show that pike minnow have about 0.4 ng/g of methyl mercury in their tissue, and project operations would increase that amount to a maximum of around 0.9 ng/g. Sacramento suckers, which are closer in size, age and morphology to Modoc suckers only have 0.195 ng/g of methyl mercury in their tissue. Modoc suckers are smaller fish, lower on the food chain, and would experience less bioaccumulation than pike minnow. Tissue concentrations due to the project in the potentially limited number of Modoc sucker individuals in the main stem of the Pit River would most likely be even less than 0.9 ng/g. Most Modoc suckers are found far enough downstream of the project that mercury concentrations should be minimal by that point due to dilution effects.

Other Species

The proposed project would not have effects on any other listed or sensitive species because of the lack of suitable habitat or lack of presence (see the Affected Environment, Section 3.3 Biological Resources).

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects to biological resources from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.4-1, 4.4-2 and 4.4-3. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.